Space Weather Technical Forecast

Issued on Friday, 09 August 2024 at 01:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Further M-class flares expected with a chance of isolated X-class flares. Occasional G1-G2/Minor to Moderate geomagnetic storms likely, mainly Days 2 and 3 (10 and 11 Aug).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: High solar activity with one X-class flare peaking at X1.3 at 08/1935 from AR3777, plus several M-class flares through the period, these also from AR3777. There are ten sunspot regions on the visible disc, of which eight are numbered. AR3780 remains the largest region on the disc, with a large negative leader spot, but also a proliferation of small spots amongst a broad area of plage to its south and southwest. However, despite its size this region has not been the most active. Instead AR3777 has been the source of most of the significant flares, despite its relatively modest size and magnetic complexity, and is currently classified as Eki/beta. Most remaining regions are magnetically simple, although AR3780 and AR3781 both have beat-gamma classifications. All of the regions on the disc where either stable or showed very slight changes over the past 24 hours.

The X-class flare produced a CME, this probably fast and likely to be Earth directed, potentially arriving day 2 or 3 (10th or 11th). Analysis will be undertaken once enough imagery is available.

Solar Wind / Geomagnetic Activity: Slow-ambient solar wind conditions mostly persisted through the period. Density remained at or below average. Interplanetary Magnetic Field, Bt, was Weak, 6nT or below while the north-south component was Weak and variable in direction, between -6nT and +6nT. Phi angle was negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background below the S1 Minor Radiation Storm threshold. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background. The 24-hour fluence was below the Active threshold with 1.46e6 integrated pfu observed at 09/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High solar activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Solar Wind /Geomagnetic Activity: A previous CME from the M4.5 flare on Aug 7th is expected to have an Earth-directed component, with arrival on Day 2 (10 Aug) expected. Additionally the filament eruption CME which left the Sun on 07 Aug is expected to pass close later on Day 2 (10 Aug), with glancing impacts possible. The CME associated with the X1.3 flare on the 8th has not been analysed yet, but is likely to have an Earth directed component, and is also likely to be fast.

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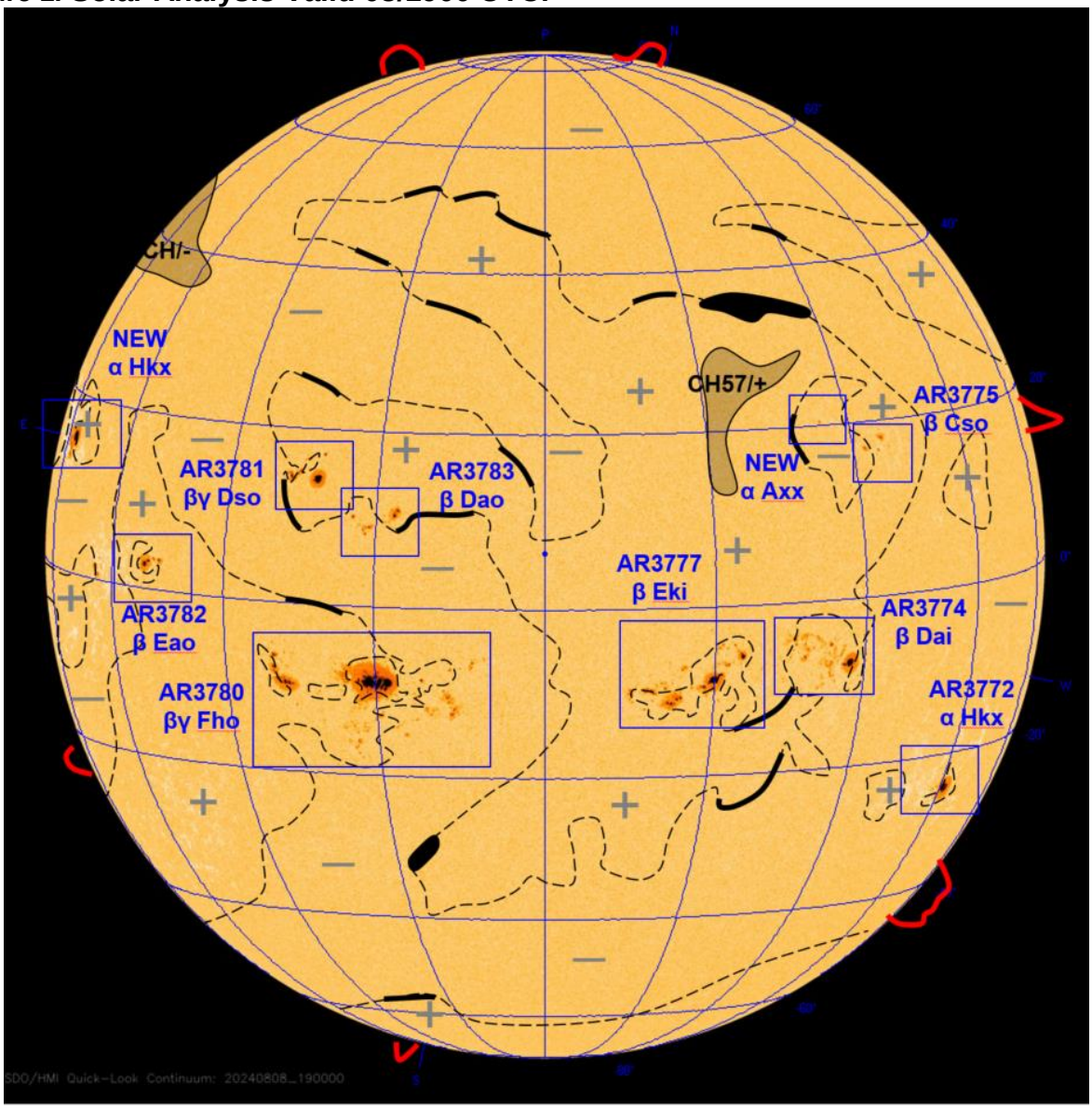
Potentially the CME could arrive later day 2 or through day 3 (11th). These CMEs combined with the possible arrival of a weak HSS from CH57 increases the chance of G1-G2/Minor to Moderate geomagnetic storms through the period. Outside of any CME influence background slow-ambient winds are expected.
Geomagnetic activity is expected to be mostly Quiet initially, with a chance of isolated Unsettled intervals. From day 2 onwards occasional G1 -G2/Minor to Moderate Storms periods are expected, with a slight chance of G3/Strong storms, especially days 2 and 3.

Energetic Particles / Solar Radiation: High energy proton flux, as observed by GOES-18, is expected to persist at background throughout the period. Any strong flares will bring the potential for a slight chance of reaching/exceeding the S1 Minor Radiation storm level. The high energy electron flux is forecast to be at mostly background levels. The associated 24-hour fluence is expected to remain below the Active threshold (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 08/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME occurred in conjunction with the M4.5 flare from AR3774 at 07/1350UTC and is likely to have an Earth-directed component. This CME produced a complex halo and may have coincided with a far sided event, complicating analysis. ENLIL analysis gives an arrival time during the morning on Day 2 (10 Aug) but this is prone to high uncertainty due to interference on coronagraph imagery from the potential aforementioned far sided event.
Additionally the filament eruption CME which left the Sun on 07 Aug is expected to pass close later on Day 2 (10 Aug), with glancing impacts possible. The CME associated with the X1.3 flare on the 8th has not been analysed yet, but is likely to have an Earth directed component, and is also likely to be fast. Potentially the CME could arrive later day 2 or through day 3 (11th). These CMEs combined with the possible arrival of a weak HSS from CH57 increases the chance of G1-G2/Minor to Moderate geomagnetic storms through the period. Outside of any CME influence background slow-ambient winds are expected.

Geomagnetic activity is expected to be mostly Quiet initially, with a chance of isolated Unsettled intervals. From day 2 onwards occasional G1 -G2/Minor to Moderate Storms periods are expected, with a slight chance of G3/Strong storms, especially days 2 and 3.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	80	60	10
Strong	G3	No	1	20	5	1
Severe	G4	No	1	5	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
07/1820 UTC	Partial	M4.5 flare from AR3774	SW	660 km/s	10/0300 UTC	Low confidence due to far sided event interfering with coronagraph imagery

Figure 2: Met Office Enlil forecast, with ensemble forecast below.

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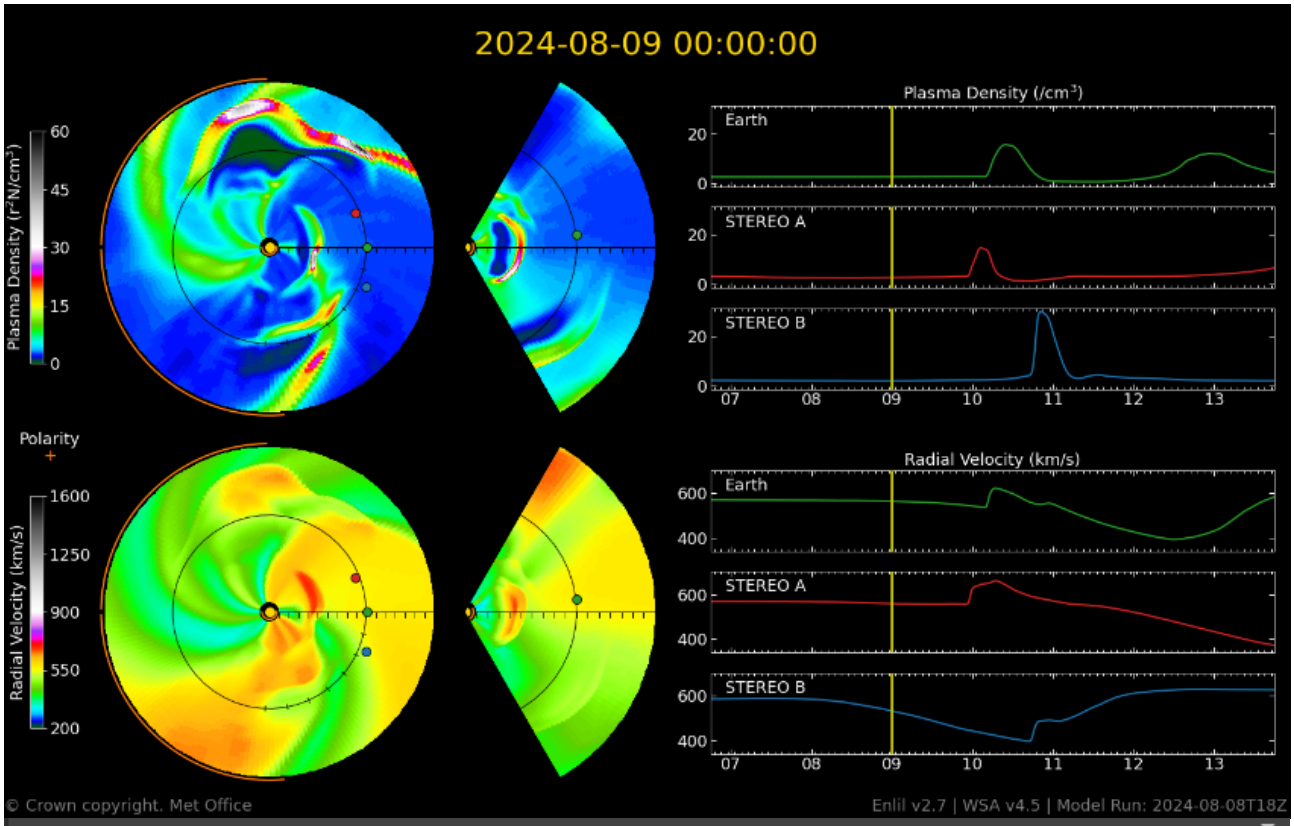

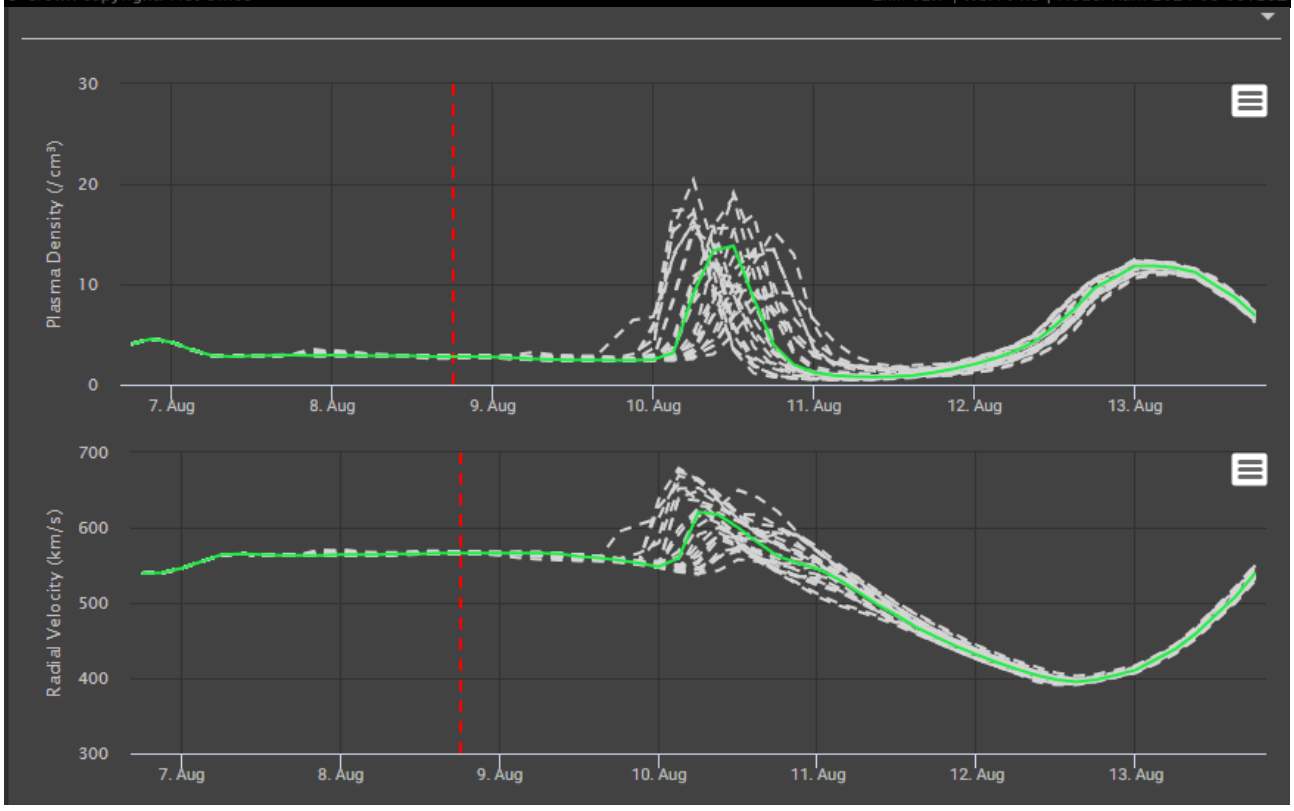

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Radio Blackouts - X-Ray Flares:

There are ten sunspot regions on the visible disc, with AR3783 recently numbered. AR3780 remains the largest region on the disc, with a proninent negative leader spot, but also a proliferation of small spots amongst a broad area of plage to its south and southwest. AR3774 and AR3777 also both remain moderately sized regions with the potential for notable flare activity. AR3775 in the northwest is a relatively small bi-polar feature with little change. AR3781 in the northeast has continued to gradually increase in spot number, with small spot emergence to the northwest of the leader spot. AR3782 in the northeast is a bi-polar region with a modest fading of the intermediate spots in the last 24 hours. AR3783 and the new region near the northeastern limb have been stable or shown only minor changes over the past few hours, as have all the other regions on the disc.

Further M-class flares are expected with a chance of an isolated X-class flare. Most of this activity is expected from the region in the southwest, but new or returning regions are expected to rotate onto the visible disc to help contribute.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	90	80	80	80
Very Active	R3 to R5 X Class	Yes	25	25	25	25

Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, was at background throughout the period. Any strong flares will bring the potential for a slight chance of reaching/exceeding the S1 Minor Radiation storm level.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	20	20	20	20
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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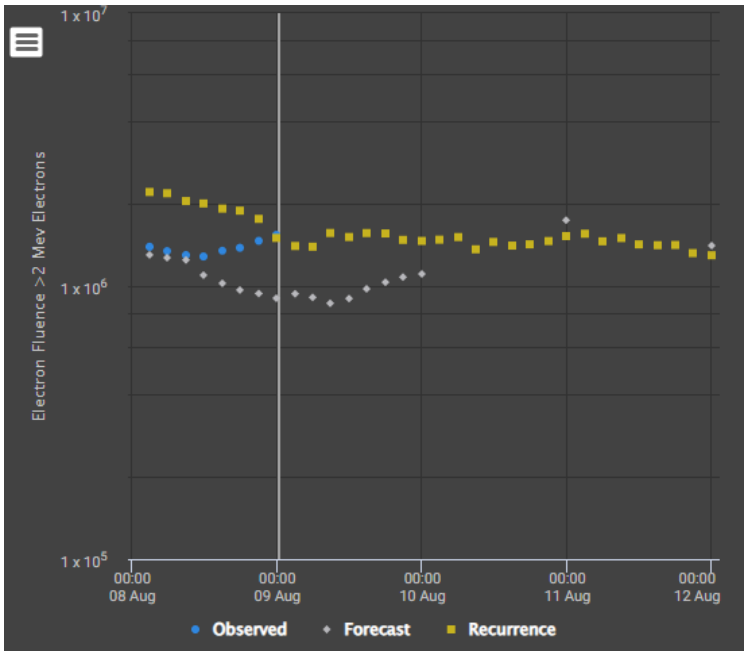
High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, is currently at background. In the absence of any notable fast wind arrivals, the observed flux is expected to remain at or near background level.
The associated 24hr electron fluence is expected to remain below Active (1e8 integrated pfu).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM model which is considered to be giving good guidance.



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